

FORM PTO-1390 (Rev. 10-95)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

1249

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/622261

INTERNATIONAL APPLICATION NO.

PCT/DE 98/03585

INTERNATIONAL FILING DATE

DECEMBER 7, 1998

PRIORITY DATE CLAIMED

FEBRUARY 14, 1998

TITLE OF INVENTION

SHAFT DRIVE DEVICE

APPLICANT(S) FOR DO/EO/US

Harald SCHACH, Ulrich HASPEL, Guenther UNGERICHT, Waldemar ERNST

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 18 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
A **SECOND** or **SUBSEQUENT** preliminary amendment.
16. ☐ A substitute specification.
17. ☐ A change of power of attorney and/or address letter.
18. ☒ Certificate of Mailing by Express Mail
19. ☐ Other items or information:

EK 70441033144

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.53) 09/622261		INTERNATIONAL APPLICATION NO. PCT/DE 98/03585		ATTORNEY'S DOCKET NUMBER 1249	
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20. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

<input type="checkbox"/> Search Report has been prepared by the EPO or JPO	\$930.00
<input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482)	\$720.00
<input type="checkbox"/> No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))	\$790.00
<input checked="" type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO	\$1,070.00
<input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	\$98.00

ENTER APPROPRIATE BASIC FEE AMOUNT =

Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	\$0.00	
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CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	FEE	TOTAL
Total claims	15 - 20 =	0	x \$18.00	\$0.00	
Independent claims	1 - 3 =	0	x \$78.00	\$0.00	
Multiple Dependent Claims (check if applicable). <input type="checkbox"/>				\$0.00	
TOTAL OF ABOVE CALCULATIONS =				\$970.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable). <input type="checkbox"/>				\$0.00	
SUBTOTAL =				\$970.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).				\$0.00	
TOTAL NATIONAL FEE =				\$970.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). <input type="checkbox"/>				\$0.00	
TOTAL FEES ENCLOSED =				\$970.00	
				Amount to be refunded	\$
				charged	\$

☐ A check in the amount of _____ to cover the above fees is enclosed.

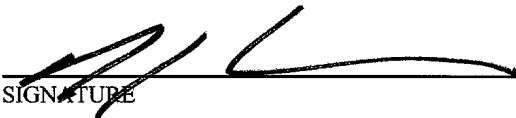
☒ Please charge my Deposit Account No. **19-4675** in the amount of **\$970.00** to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **19-4675** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

STRIKER, STRIKER & STENBY
103 EAST NECK ROAD
HUNTINGTON, NEW YORK 11743



SIGNATURE

MICHAEL J. STRIKER

NAME

27233

REGISTRATION NUMBER

AUGUST 14, 2000

DATE

09/622261

534 Rec'd PCT/PTO 14 AUG 2000

UNITED STATES PATENT AND TRADEMARK OFFICE

In re:

Applicant: SCHACH, H., et al

Serial No.:

Filed: Simultaneously

For: SHAFT DRIVE DEVICE

SIMULTANEOUS AMENDMENT

August 14, 2000

Hon. Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sir:

Simultaneously with filing of the above identified application,
please amend the same as follows:

09/622261-101000

In the specification:

534 Rec'd PCT/PTO 14 AUG 2000

Page 1, line 2, replace "Prior Art" with -- Background of the
Invention --,

Page 2, line 6, replace "Advantages" with -- Summary --,

between lines 6 and 7, insert -- Accordingly, it is an
object of present invention to provide a shaft drive device which avoids the
disadvantages of the prior art.

In keeping with these objects and with these objects and with
others which will become apparent hereinafter, one feature of present
invention resides, briefly stated, in a shaft drive device, which has a printed
circuit board device with a dial, a rotor device with a rotor shaft attached to
it, a stator device for driving the rotor with the rotor shaft, and an attachment
device for attaching the rotor device and the stator device to the printed
circuit board in such a way that the printed circuit board device forms a part
of a frame surrounding the rotor shaft of the shaft drive device.

When the shaft drive device is designed in accordance with the
present invention it --,

line 7, delete in its entirety,

line 8, delete "having the characteristics of claim 1",

last paragraph on bottom of page, delete on its entirety.

Page 5, line 5, before "DRAWINGS" insert -- BRIEF DESCRIPTION OF THE --.

Page 6, line 6, replace "Exemplary" with -- Preferred --.

Page 16, line 1, after "Abstract" insert -- With the Disclosure --.

In the claims:

Cancel all claims without prejudice.

Add the following claims:

16. A shaft drive device for a pointer of a gauge instrument, comprising a printed circuit board device with a dial; a rotor device with a rotor and a rotor shaft attached to said rotor; a stator device for driving said rotor with said rotor shaft; an attachment device for attaching said rotor device and said stator device to said printed circuit board device in such a way that said printed circuit board device forms a part of a frame surrounding said rotor shaft.

17. A shaft drive device as defined in claim 16, wherein said printed circuit board device has a leads through for said rotor shaft.

18. A shaft drive device as defined in claim 16, wherein said rotor shaft is provided with at least one radial bearing bush, said printed circuit board device having an axial bearing bush cooperating with said at least one radial bearing bush.

19. A shaft drive device as defined in claim 18, wherein said axial bearing bush is formed of one piece with said printed circuit board device.

20. A shaft drive device as defined in claim 18, wherein said axial bearing bush is formed as an insert receivable in said printed circuit board device.

21. A shaft drive device as defined in claim 16, wherein said rotor shaft is passable through said printed circuit board device from a side of said printed circuit board device to a stop, with said rotor remaining on another side of said printed circuit board device.

22. A shaft drive device as defined in claim 17, wherein said stator device is attachable to said printed circuit board device all the way around said leadthrough for said rotor.

23. A shaft drive device as defined in claim 16, wherein said stator device is attached to an insert.

24. A shaft drive device as defined in claim 23, wherein said attachment device is formed so that it axially supports said rotor shaft on an opposite side of said printed circuit board device.

25. A shaft drive device as defined in claim 24, wherein said attachment device has a lid which is attachable to another side of said printed circuit board device and which has an axial bearing bush for receiving a corresponding end of said rotor shaft.

26. A shaft drive device as defined in claim 25, wherein said lid is locked in said printed circuit board device.

27. A shaft drive device as defined in claim 16; and further comprising an aligning device which aligns said stator device with said printed circuit board device.

28. A shaft drive device as defined in claim 27, wherein said aligning device includes centering pins.

29. A shaft drive device as defined in claim 16; and further comprising a spacer attached between said rotor and said stator device.

30. A shaft drive device as defined in claim 16, wherein said stator device is attached to a wiring of said printed circuit board device; and further comprising attaching means for attaching said stator device to said wiring of said printed circuit board device and selected from the group consisting of soldering attaching means and adhesive attaching means.

31. A shaft drive device as defined in claim 16, wherein said stator device is formed as a unit including a stator core coil region, a stator winding located on the later, and a stator arm region.

In the abstract:

Line 1, delete "The present invention creates a" and replace with -- A --,

Line 2, replace "having:" with -- has --,

Last line delete "(Fig. 1)".

REMARKS

This Amendment is submitted simultaneously with filing of the above identified application.

With the present Amendment, applicants have amended the specification to bring it in compliance with the requirements of the U.S. Patent Practice.

The original claims have been canceled and replaced with a new set of claims including claim 16, the broadest claim on file, and claims 17-31 which depend on it. The claims have been drafted to clearly define the present invention.

Consideration and allowance of present application is most respectfully requested.

Should the Examiner require or consider it advisable that the specification, claims and/or drawings be further amended or corrected in formal respects in order to place this case in condition for final allowance, then it is respectfully requested that such amendments or corrections be carried out by Examiner's Amendment, and the case be passed to issue. Any costs involved should be charged to the deposit account of the

undersigned (No. 19-4675). Alternatively, should the Examiner feel that a personal discussion might be helpful in advancing this case to allowance, he is invited to telephone the undersigned (at 631-549-4700).

Respectfully submitted,



Michael J. Striker
Attorney for Applicants
Reg. No. 27233

09/622261

534 Rec'd PCT/PTO 14 AUG 2000

SHAFT DRIVE DEVICE

PRIOR ART

5 The present invention relates to a shaft drive device, having: a PCB (printed circuit board) device; a rotor device with a rotor and a rotor shaft attached to it; and a stator device for driving the rotor with the rotor shaft.

10 Although in principle it can be used for arbitrary shaft drive devices, the present invention and the problems it seeks to solve will be explained in terms of a shaft drive device for use in a gauge/control instrument or combination instrument of a motor vehicle, for instance as a pointer shaft drive device for the pointer of a gauge instrument.

15 In a modern gauge/control instrument or combination instrument of a motor vehicle, many functions are now provided. Although a number of digital gauge instruments are used, nevertheless for the sake of expediency, some pointer instruments are also used, which each require a pointer shaft drive device.

20 It is quite conventional to mount such a shaft drive device, for instance a stepping motor, as an independent component on a PCB device and put it in contact with the PCB device. However, this kind of procedure is complicated and expensive from a production standpoint and requires a large amount of space for installation.

5 The problems the present invention seeks to solve accordingly reside in creating an economical, space-saving and easily installed shaft drive device, in particular for use in a gauge/control instrument or combination instrument of a motor vehicle.

ADVANTAGES OF THE INVENTION

10 The shaft drive device according to the invention having the characteristics of claim 1 has the advantage that it is compact, especially with a low structural height, and can be produced with a smaller number of components. It is easy to put together and simple to contact, for instance by the SMD (surface mounting device) technique. All SMD parts can be assembled automatically, which simplifies manufacture substantially.

15 The concept on which the present invention is based is that the stator device and the rotor device can be attached to the PCB device in such a way that the PCB device forms part of the frame, surrounding the rotor shaft, of the shaft drive device. In particular, this makes it possible to integrate the axial guidance or bearing of the rotor shaft with the PCB device. Thus the concept according to the invention offers the opportunity of undoing the shaft drive device as an independent component group and partly integrating it into the PCB device instead.

25 Advantageous refinements and improvements of the shaft drive device defined by claim 1 are found in the dependent claims.

In a preferred refinement, the PCB device has a leadthrough for the rotor shaft. It is thus possible to attach the pointer to the rotor shaft on one side of the PCB device and to provide the rotor and the stator device on the other side.

In a further preferred refinement, in the PCB device an axial bearing bush for cooperation with at least one radial bearing bush provided on the rotor shaft is provided.

In a further preferred refinement, the axial bearing bush is embodied in one piece with the PCB device.

In a further preferred refinement, the axial bearing bush is embodied in an insert that can be received in the PCB device. The stator device can be attached to this insert in advance in a suitable orientation.

In a further preferred refinement, the rotor shaft can be passed through the PCB device from side of the PCB device to a stop, with the rotor remaining on the other side of the PCB device. This simplifies the installation of the rotor shaft, since the stop prevents the rotor shaft from slipping through.

In a further preferred refinement, the stator device can be attached to the PCB device all the way around the leadthrough for the rotor.

In a further preferred refinement, the stator device can be attached to the insert. The insert may be

a small precision-manufactured part, to which the stator device can be attached in a precisely calibrated way.

5 In a further preferred refinement, the attachment device is designed such that it axially supports the rotor shaft on the other side of the PCB device. The force occurring when the pointer is slipped on is thus counteracted.

10 In a further preferred refinement, the attachment device has a lid, which can be attached to the other side of the PCB device and which has an axial bearing bush for receiving the corresponding end of the rotor shaft. Thus two functions can be united in a single component, namely a bearing function and a protective function.

15 In a further preferred refinement, the lid can be locked in the PCB device. This is a simple, sturdy way of doing the attaching.

20 In a further preferred refinement, the stator device can be aligned with the PCB device via an alignment device, preferably centering pins.

In a further preferred refinement, a spacer can be attached between the rotor and the stator device. This spacer assures a correct alignment of the rotor and stator device.

25 In a further preferred refinement, the stator device can be attached by SMD soldering or adhesive bonding to the wiring of the PCB device.

In a further preferred refinement, the stator device forms a unit, which has a stator coil core region, a stator winding located thereon, and a stator arm region.

5

DRAWINGS

Exemplary embodiments of the invention are shown in the drawings and described in further detail in the description below.

Shown are:

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Fig. 1, a cross-sectional view of a first embodiment of the shaft drive device of the invention, in various stages of assembly;

Fig. 2, a cross-sectional view of a second embodiment of the shaft drive device of the invention, in various stages of assembly;

Fig. 3, a view from below of a first example of the stator device, attached to the PCB device and with the rotor device inserted;

Fig. 4, a view from below of a second example of the stator device, attached to the PCB device and with the rotor device inserted;

Fig. 5, a view from below of a third example of the stator device, attached to the PCB device and with the rotor device inserted;

Fig. 6, a view from below of a fourth example of

the stator device, attached to the PCB device and with the rotor device inserted; and

Fig. 7, a view from below of a fifth example of the stator device, attached to the PCB device and with the rotor device inserted.

DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

In the drawings, the same reference numerals pertain to identical or functionally identical components.

Fig. 1 is a cross-sectional view of a first embodiment of the shaft drive device of the invention, in various stages of assembly.

Fig. 1 shows a printed circuit board or PCB 1; a luminous disk 2; a dial 3; a stator device 40 with a stator coil core region 4, a stator winding 41, and a stator arm region 42; a rotor device 50 with a rotor 5, a rotor shaft 51, and a double radial bearing bush 52; a pointer 8; wiring 10 of the PCB device 1; a radial bearing bush 11; a leadthrough 12 for the rotor shaft 51; a mounting 13 for the dial 3; a stop 15; one hole 16 for receiving each detent protrusion; an attachment device 60 with a lid 6, an axial bearing bush, and a detent protrusion 62 for the holes 16.

The first embodiment shown in Fig. 1 shows the layout according to the invention of a stepping motor for an electronic combination instrument as a pointer drive mechanism; contacting is provided via the wiring 10 of the PCB device 1. By the partial integration,

according to the invention, of the shaft drive device with the PCB device 1, the height of the stepping motor is reduced on the one hand, and its assembly is simplified on the other.

5 The steps required for assembling the shaft drive device in the first embodiment will now be described in further detail.

10 On the PCB device 1, the luminous disk 2 and the dial 3 are attached to the front side (the top in Fig. 1). The stator device 40 is also mounted on the back side of the PCB device 1, specifically by an SMD joining method, such as adhesive bonding or soldering.

15 Care must be taken to provide the correct alignment, that is, the correct spacing between the rotor 5 and the bunching face of the stator arm region 42 for the magnetic field at the rotor 5. To set this spacing correctly, various options exist. In the present example, in reflow soldering or conductive adhesive bonding of the stator device 40 to the PCB device 1, a mounting rotor (not shown) is carried along, in magnetized form, and thus assures the correct spacing during the mounting process. After the mounting process, the mounting rotor is removed again.

20 Once the stator device 40 has been mounted, the insertion of the rotor device 50 is done, from the back side of the PCB device 1, until the upper radial bearing bush 52 strikes the stop 15 on the upper edge of the radial bearing bush 11. Next, the attachment device 60, which in the present example comprises the lid 6 with the axial bearing bush 61 and the detent protrusions 62,

is locked in detent fashion or snapped onto the PCB device 1, in its holes 16.

Once the lid 6 has been mounted on the PCB device 1, the assembly of the stepping motor is concluded, and the assembled component group represents the stepping motor in its known form.

To make the pointer instrument complete, the pointer 8 is mounted on the rotor shaft 51 from the front side of the PCB device 1. On its other side, the rotor shaft 61 is braced in the axial bearing bush 61 of the lid 6.

Fig. 2 is a cross-sectional view of a second embodiment of the shaft drive device of the invention, in various stages of assembly.

In Fig. 2, in addition to the reference numerals already given, 1' designates a PCB device embodied differently, that is, with a recess 14, and 101 designates an insert for reception in the recess 14.

In the second embodiment shown in Fig. 2, the axial bearing bush 11' is embodied in an insert 101 that can be received in the recess 14 of the PCB device 1'. The stator device 40, which forms a unit that has the stator coil core region 4, the stator winding 41 located therein, and the stator arm region 42, is attached in advance to the insert 101. Since the insert 101 is small, it can be made from a special, extremely dimensionally precise plastic, which in the final analysis assures the correct disposition on the PCB device 1' and thus the correct spacing between the rotor

5 and the stator unit 40.

5 The connection between the insert 101 and the PCB device 1' is expediently accomplished both positively and nonpositively by clamping or adhesive bonding or the like.

The remaining layout corresponds to that of the first embodiment in Fig. 1.

10 Fig. 3 is a view from below of a first example of the stator device, attached to the PCB device and with the rotor device inserted.

In Fig. 3, in addition to the reference numerals already given, 45 indicates an alignment device in the form of centering pins, and 420 indicates a mounting for holding the stator device 40 together.

15 In the first example of the stator device 40 shown in Fig. 3, the stator arm region 42 extends substantially perpendicular to the stator coil core region 4. The two halves of the stator device 40 are joined via the mounting 420, so that the entire stator device 40 forms a unit, which is attached, aligned by the centering pins 45, to the back side of the PCB device 1.

20 Fig. 4 is a view from below of a second example of the stator device, attached to the PCB device and with the rotor device inserted.

25 In Fig. 4, in addition to the reference numerals already listed, 110 indicates a collar of the PCB device

1 (see Fig. 1) or of the insert 101 (see Fig. 2), which acts as a spacer between the rotor 5 and the stator device 40.

5 In the second example of the stator device 40 shown in Fig. 4, the spacer 110 is attached between the rotor 5 and the stator device 40, or in other words in the region of the bunching face; the spacer is expediently a thin plastic ring, on which the stator device 40 rests with its bunching face, virtually
10 without tolerances on the principle of a spring. The thickness of the spacer 110 is accordingly selected such that the rotor 5 can rotate without major frictional resistance.

15 Otherwise, this second is identical to the first example of the stator device 40 described in conjunction with Fig. 3.

20 Fig. 5 is a view from below of a third example of the stator device, attached to the PCB device and with the rotor device inserted.

25 In Fig. 5, in addition to the reference numerals already listed, 42' designates a modified stator arm region; 43' designates a setting for the modified stator arm region 43'; and 420' designates a correspondingly modified mounting.

30 In the third example of the stator device 40 shown in Fig. 5, the two halves of the stator device 40 are U-shaped, but each of the stator windings 41 is located in one leg of the U, or in other words the lower leg in terms of Fig. 5. Also, there is only one mounting 420'

for holding together the two halves of the stator device 40. Settings 43' for receiving the stator arm region 42' are additional provided on the back side of the PCB device 1.

5 Fig. 6 is a view from below of a fourth example of the stator device, attached to the PCB device and with the rotor device inserted.

10 In Fig. 6, in addition to the reference numerals already listed, 42'' designates a modified stator arm region and 43'' designates a setting for the modified stator arm region 43''.

15 In the fourth example of the stator device 40 shown in Fig. 6, the two halves of the stator device 40 are V-shaped, with the stator winding 41 provided on each leg of the V. In this example, the two halves of the stator device 40 are not joined together; instead, they are fitted into the corresponding fit 43'' of the PCB device 1, and the centering pins 45, as in the above cases, assure the correct alignment.

20 Fig. 7 is a view from below of a fifth example of the stator device, attached to the PCB device and with the rotor device inserted.

25 In the fifth example of the stator device 40 shown in Fig. 7, four stator coil core regions 4 with a corresponding stator winding 41 are provided, which are at an angle of 90° from one another and do not cohere with one another but instead are attached individually to the back side of the PCB device 1.

Although the above invention has been described above in terms of preferred exemplary embodiments, it is not limited to them but instead can be modified in manifold ways.

5 In particular, the shape of the stator device 40 can be varied substantially arbitrarily. It is furthermore possible to make the connection between the stator device 40 and the PCB device 1 in some other way than by the SMD technique. Finally, the pointer 8 can
10 also be attached to the other side of the rotor shaft 51 instead, and in that case the stop 15 acts as an axial bearing. The radial bearing bush can also be attached to the top or the bottom side of the PCB device 1.

CLAIMS

1. A shaft drive device, having:

a PCB device (1, 1');

a rotor device (50; 5, 51) with a rotor (5) and a rotor shaft (51) attached to it; and

5 a stator device (40) for driving the rotor (5) with the rotor shaft (51);

an attachment device (60) for attaching the rotor device (50; 5, 51) and the stator device (40) to the PCB device (1, 1') in such a way that the PCB device (5) forms part of the frame, surrounding the rotor shaft, of the shaft drive device.

2. The shaft drive device of claim 1, characterized in that the PCB device (1, 1') has a leadthrough (12) for the rotor shaft (51).

3. The shaft drive device of claim 1 or 2, characterized in that in the PCB device (1, 1') an axial bearing bush (11, 11') for cooperation with at least one radial bearing bush (52) provided on the rotor shaft (51) is provided.

4. The shaft drive device of claim 3, characterized in that the axial bearing bush (11) is embodied in one piece with the PCB device (1, 1').

5. The shaft drive device of claim 3,

characterized in that the axial bearing bush (11') is embodied in an insert (101) that can be received in the PCB device (1, 1').

6. The shaft drive device of one of claims 2-5, characterized in that the rotor shaft (51) can be passed through the PCB device (1, 1') from side of the PCB device (1, 1') to a stop (15), with the rotor (5) remaining on the other side of the PCB device (1, 1').

7. The shaft drive device of one of claims 2-6, characterized in that the stator device (40) can be attached on the PCB device (1, 1') all the way around the leadthrough for the rotor (5).

8. The shaft drive device of one of claims 5-7, characterized in that the stator device (40) can be attached to the insert (101).

9. The shaft drive device of claim 8, characterized in that the attachment device (60) is designed such that it axially supports the rotor shaft (51) on the other side of the PCB device (1, 1').

10. The shaft drive device of claim 9, characterized in that the attachment device (60) has a lid (6), which can be attached to the other side of the PCB device (1, 1') and which has an axial bearing bush (61) for receiving the corresponding end of the rotor shaft (51).

11. The shaft drive device of claim 10, characterized in that the lid (6) can be locked in the PCB device (1, 1').

12. The shaft drive device of one of claims 8-11, characterized in that the stator device (40) can be aligned with the PCB device (1, 1') via an alignment device (45), preferably centering pins.

13. The shaft drive device of one of the foregoing claims, characterized in that a spacer (110) can be attached between the rotor (5) and the stator device (40).

14. The shaft drive device of one of the foregoing claims, characterized in that the stator device (40) can be attached by SMD soldering or adhesive bonding to the wiring (10) of the PCB device (1, 1').

15. The shaft drive device of one of the foregoing claims, characterized in that the stator device (40) forms a unit, which has a stator coil core region (4), a stator winding (41) located thereon, and a stator arm region (42).

ABSTRACT

The present invention creates a shaft drive device, having: a PCB device (1, 1'); a rotor device (50; 5, 51) with a rotor (5) and a rotor shaft (51) attached to it; and a stator device (40) for driving the rotor (5) with the rotor shaft (51); an attachment device (60) for attaching the rotor device (50; 5, 51) and the stator device (40) to the PCB device (1, 1') in such a way that the PCB device (5) forms part of the frame, surrounding the rotor shaft, of the shaft drive device.

(Fig. 1)

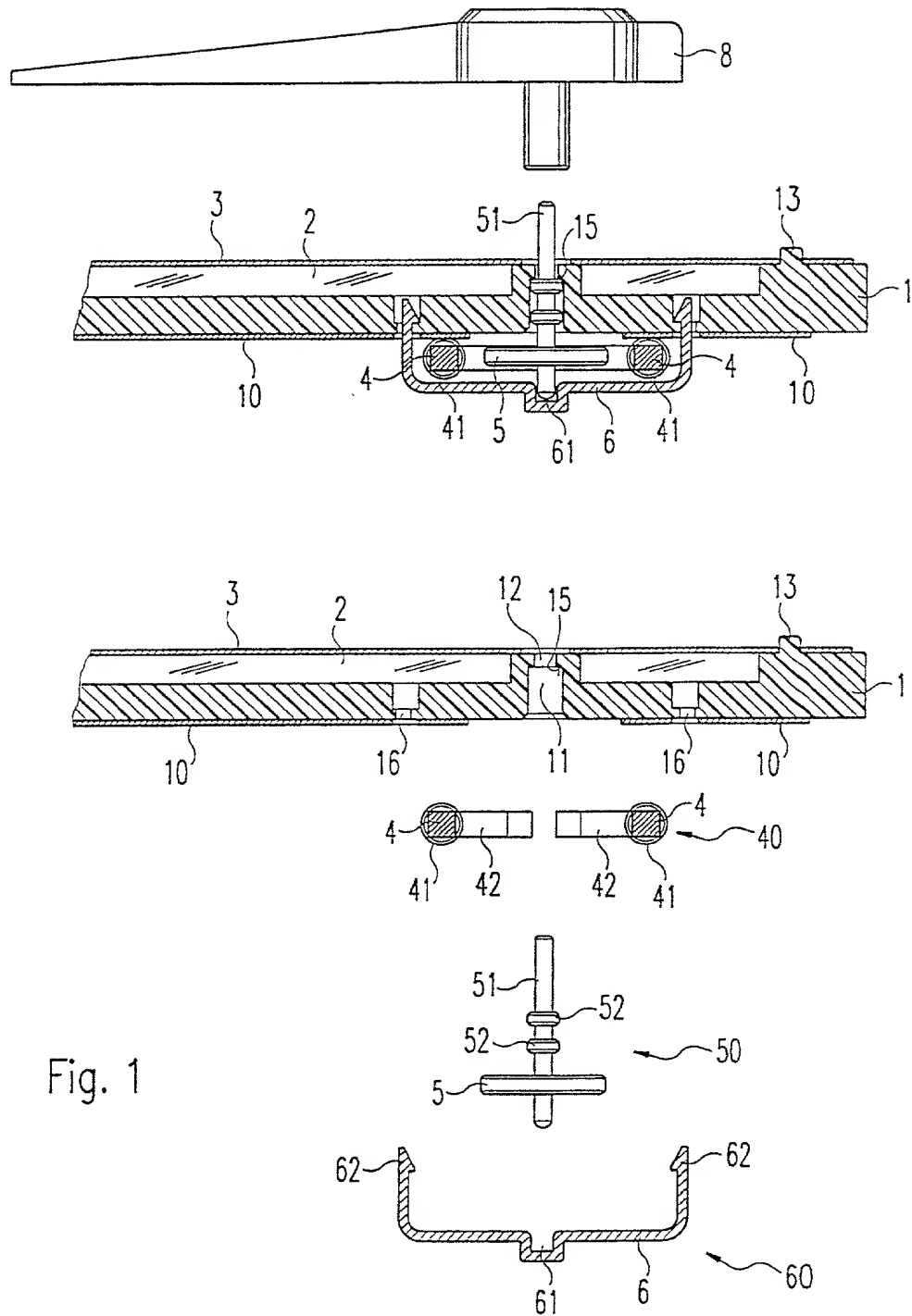


Fig. 1

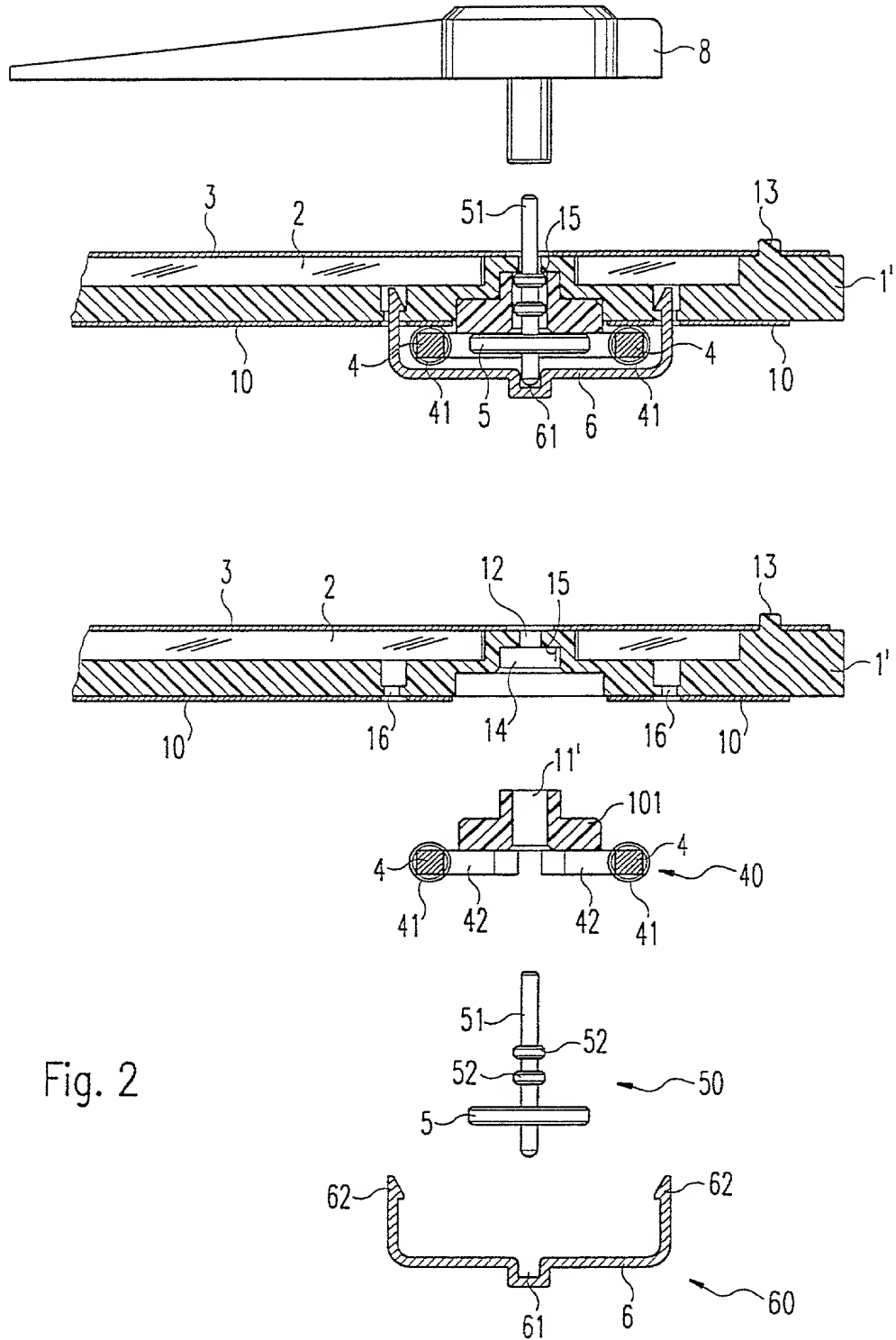


Fig. 2

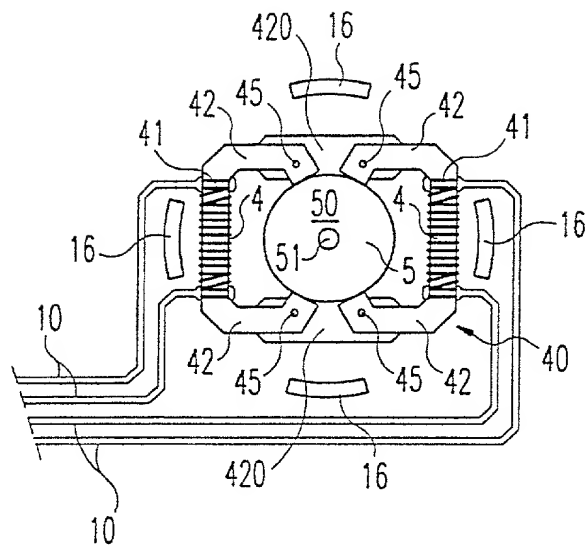


Fig. 3

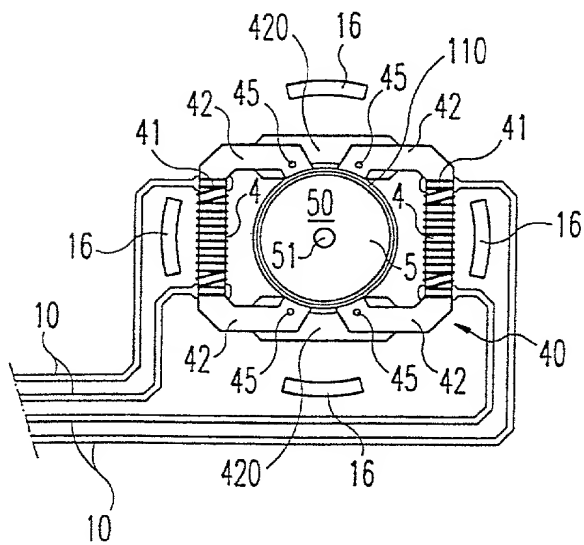


Fig. 4

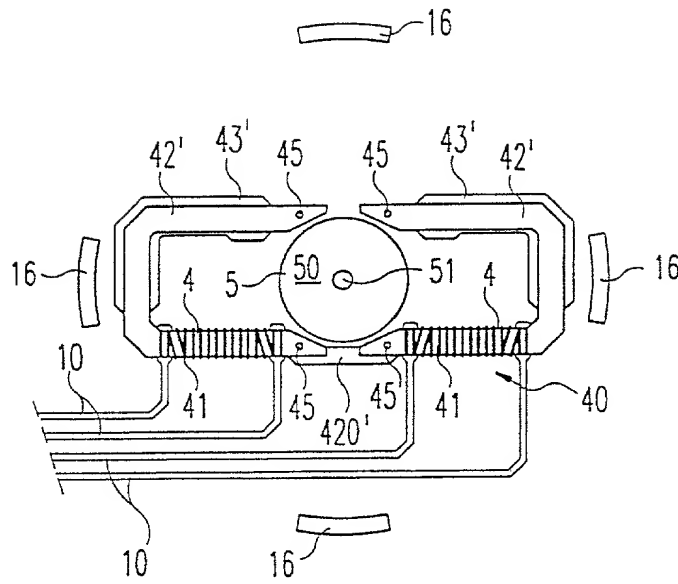


Fig. 5

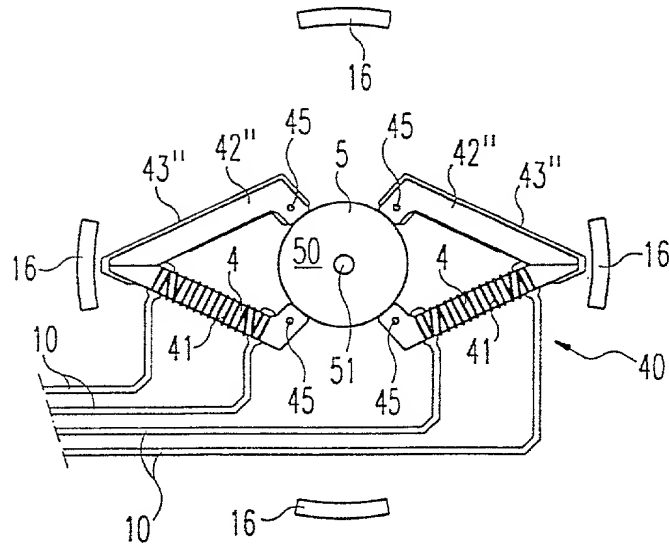


Fig. 6

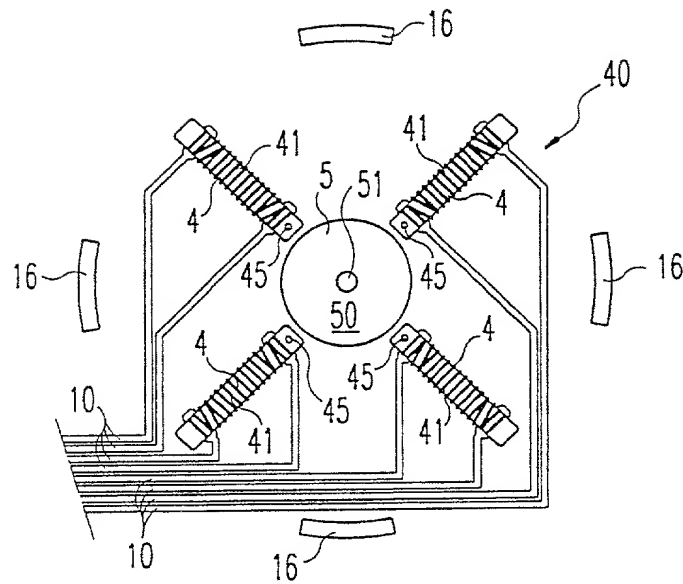


Fig. 7

09/622261-101000

DECLARATION AND POWER OF ATTORNEY FOR NATIONAL STAGE OF PCT PATENT APPLICATION

As a below-named inventor, I hereby declare that:

Harald SCHACH
Ulrich HASPEL
Guenther UNGERICH
Waldemar ERNST

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **SHAFT DRIVE DEVICE** the specification of which was filed as PCT International Application number PCT/DE 98/03585 on December 7, 1998.

I hereby state that I believe the named inventor or inventors in this Declaration to be the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior foreign application(s):

Priority claimed:

<u>198 06 118.8</u>	<u>GERMANY</u>	<u>FEBRUARY 14, 1998</u>	<u>X</u>	
(Number)	(Country)	(Date filed)	Yes	No
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
(Number)	(Country)	(Date filed)	Yes	No

As a named inventor, I hereby appoint the following attorney to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Michael J. Striker, Reg. No. 27233

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statement may jeopardize the validity of the application or any patent issued thereon.

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Signature:	Date:	Residence and Full Postal Address:
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Signature:	Date:	Residence and Full Postal Address:
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